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On BPP versus NP ∪ coNP for ordered read-once branching programs

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Abstract

We investigate the relationship between probabilistic and nondeterministic complexity classes PP, BPP, NP and coNP with respect to ordered read-once branching programs (OBDDs). We exhibit two explicit Boolean functions q_n, R_n such that: (1) $q_n : \{0,1\}^n \to \{0,1\}$ belongs to BPP $\setminus$ (NP ∪ coNP) in the context of OBDDs; (2) $R_n : \{0,1\}^n \to \{0,1\}$ belongs to PP $\setminus$ (BPP ∪ NP∪coNP) in the context of OBDDs. Both of these functions are not in AC^0.

1. Preliminaries

Ordered binary decision diagrams (for short OBDDs) are also known as deterministic ordered (or oblivious) read-once branching programs. OBDDs are important tools in the field of digital design and hardware verification (see, for example, [8, 21]). The reason for this is that the manipulation (testing for equivalence and other Boolean operations) with OBDDs can be performed in deterministic polynomial time. But for this convenience we "pay a sensible tax": some important (for practice) Boolean functions cannot be represented by polynomial size OBDDs (see, for example, [16]). So, the important task is to investigate reasonable generalizations of OBDD model of

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